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ABSTRACT

This module is primarily designed to focus on two main areas: graphing and map reading. Graphing entails the use of bar, line, and circle graphs, the x and y axes, the coordinate plane, and ordered pairs. Map reading includes conversion tables, approximations, devising scales, and learning to refold a folding map. (Author/MK)

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TOPICAL MODULE FOR USE

IN A

MATHEMATICS LABORATORY SETTING

TOPIC: Travel

by

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A Publication of

University of Denver
Mathematics Laboratory
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Dr. Ruth I. Hoffman, Director

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SE 030 321

This module is designed to be used as follows:

1. It may be used with a pretest, as suggested in the testing procedures.
2. With the entire class as one group.
3. Individualized student activities.
4. Groups of students interested in the same section of the country.
5. Teacher selection of a group method of their own choosing.

Materials

Contained in this module:

1. Acetate grid
2. A paper protractor
3. Metric chart and table
4. Motel rate chart
5. Temperature chart
6. Number lines.

Teacher must provide:

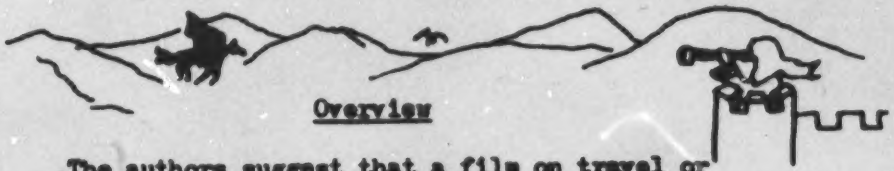
1. Ruler
2. Paper clips
3. Scissors
4. Game score sheets
5. Folding road map.

Time Schedule

During field testing, this module took an average of _____ fifty-minute class period to complete.

Objectives

1. To introduce the student to mathematical concepts involved while planning and executing a trip.
2. To emphasize the mastery of the four basic operations of arithmetic.
3. To encourage research necessary to plan a trip by auto or air.
4. To build a foundation for adequate planning and execution of a trip.



Overview

.The authors suggest that a film on travel or personal slides and pictures begin the unit, in hopes of serving as a motivating force and showing practical applications of mathematics in travel.

.This module is primarily designed to focus on two main areas: graphing and map reading. Graphing entails the use of bar, line, and circle graphs, the x and y axes, the coordinate plane and ordered pairs. Map reading includes conversion tables, approximations, devising scales, and perhaps even learning to refold a folding map.

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TESTING PROCEDURE

Pretest

1. The pretest is used only as a means of introduction, and successful or unsuccessful completion does not determine prior preparation.

2. The pretest is used only as a preview of topics to be introduced in the module.

3. The pretest is for a self-evaluation for the student to crystalize learning.

Posttest

1. The posttest checks to see if the student is able to successfully complete the objectives established to plan a trip.

2. It is suggested that the posttest be a take-home test with at least two or three days allowed for research. The experience of this type of test in mathematics, although different, may prove interesting to the student.

Answers to Pretest

1. 360 degrees
2. 33 1/3%
3. 1.1 yd.
4. About $45 each
5. Answers will vary.
6. Answers will vary.
7. 17.4¢

BACKGROUND NOTES

(For Cards A)

The numbers which follow correspond to the activity cards and give brief background notes on the activities.

1. This activity pertains to map reading with particular attention to meridians and parallels. Students should recognize where the divisions are located and whether the division is in degrees or time. Any large United States map will suffice.

2. (a) This activity is a continuation of map reading with destination of particular coordinates of random cities. The activity involves estimating, consequently students may require help in approximating divisions.

   (b) This activity gets into coordinate pairs, where parallels represent the first component of a coordinate pair and meridians represent the second component.

3. (a) The idea of the number line is introduced or reviewed with manipulatives. It may be helpful to point out some 90° angles as examples.

   (b) The coordinate plane is presented as two number lines with the locations and signs of the four quadrants.

4. The importance of order in coordinate pairs is emphasized because the activity asks for the coordinates of specific cities indicated. Parallelism may need some explanation. The grid for the worksheet is designed for first quadrant points only.

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5. How coordinate pairs are determined by the origin is the notion of this activity.

6. All four quadrants are involved as students designate quadrants for particular cities. Teachers should see if students are getting the idea of quadrants just from observing coordinate pairs.

7. This activity requires research or access to a current reference such as encyclopedia, dictionary, etc. Some examples which depict descending order could be used.

   Rounding numbers using whatever guides the teacher prefers could help when estimating.

8. Concerns estimating distances using various means such as push-pins and string, rulers or other linear measurers, etc.

   Airlines basically follow straight routes (no streets, curves, corners, etc.) and that is similar to what measuring in the first problem would have been, when measuring the shortest distance between two points and getting a straight line. Reading a table is also included.

9. The first bar graphs are presented to show different ways of representing data.

10. This activity tries to involve the idea of the ease of comparing data sometimes, when the data is in the form of bar graphs. It may be helpful to explain how graphs are pictorial devices. The students should use the same company for all five cities, if possible. This activity gets at the simple development of the formula for finding percentages:

$$\frac{\text{Amount Saved}}{\text{Amount of first class}} \times 100 = \% \text{ saved}$$

11. This activity is to stress the construction of bar graphs.

12. Comparing two sets of data on same graph to get information about both sets.

13. Student has to determine what must be included, used, or necessary to specify cost per mile.

$$\left(= \frac{\text{cost from Denver}}{\text{actual miles}} \right)$$

14. Activity employs the use of graphs to answer questions and help solve problems.

15. Teachers should emphasize that when converting hours to minutes, minutes to hours, or combinations of the two, that computations must be done in one or the other; i.e., they cannot compute with unlike terms. To find time when given number of miles and miles-per-hour (the speed), the miles are reduced and you are left with hours.

    Time zones in relation to travel are involved in this activity.

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ANSWER SHEET

(Section A)

A-1 Degree (Top)
Time (Bottom)

A-2c

City	A	B	C
New Orleans	30	90	(30, 90)
San Francisco	38	122	(38, 122)
Anchorage	62	150	(62, 150)
Seattle	47	122	(47, 122)
London	50	0	(50, 0)
Julianehaab	62	45	(62, 45)
Monrovia	7	10	(7, 10)

A-3a

1. Vertical
2. Horisontal
3. Top
4. Left
5. Right
6. Bottom
7. Center
8. Center
9. (0, 0)

A-4a

1. Fourth
2. Second
3. Third
4. First and third
5. First and second
6. Second and third
7. First and fourth
8. Third and fourth

A-5c

Denver (12, 13)	New Orleans (23, 4)
San Fran. (0, 14)	St. Louis (22, 12)
Reno (2.5, 15)	Minnesota (20, 17.5)
Dallas (17.5, 6.5)	Chicago (23.5, 15)
Browns (17, .25)	Atlanta (27, 8)

A-6c

Spokane	(-12, 8)	(-21, 8)
Portland	(-14, 7)	(-23, 7)
Las Vegas	(-11, -2)	(-20, -2)
Helena	(-7, 6)	(-16, 6)
Amarillo	(-2, -5)	(-11, -5)
Sioux Falls	(1, 3)	(-8, 3)
Dallas	(2, 7)	(-7, -7)
Houston	(2, 10)	(-7, -10)
Chicago	(8, 1)	(-1, 1)
Nashville	(9, -4)	(0, -4)
Detroit	(10, 2)	(1, 2)
Buffalo	(14, 3)	(5, 3)
Norfolk	(16, -2)	(7, -2)
Miami	(16, -12)	(7, -12)

Yes. Yes, it was changed.

A-7a Answers will vary depending upon source and year.

Atlas, 1972

New York	7,900,000
Chicago	3,400,000
Los Angeles	2,800,000
Philadelphia	1,900,000
Detroit	1,500,000
Houston	1,200,000
Baltimore	900,000
Dallas	800,000
Washington, D.C	800,000
Cleveland	800,000

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A-8a

Atlanta	1208
Boston	1766
Memphis	880
Seattle	1020
San Diego	840

Yes, it is the actual mileage.

A-9a Answers will vary, depending upon starting place and cities selected.

A-10a Answers will vary, depending upon airlines and routes selected.

A-11b Answers will vary.

A-13 $\frac{\text{Cost}}{\text{Miles}}$ = Cost per mile.

A-15b Answers will vary.

BACKGROUND NOTES

(For Cards B)

1. Have only one student write each letter. Replies can be posted on the bulletin board for easy reference, but they should also be shared and discussed in class.

2. The map reading is a simple worksheet and students shouldn't require individual help.

3. (a) The measuring wheel is easy to assemble and to use.

   (b) Only one student can use the measuring wheel on the large map at one time; two maps would speed up this activity and possibly students could work in pairs.

4. This activity is self-explanatory. If a mileage chart is available, it would be interesting to see how close the measuring wheel comes to the actual distance. You might discuss "horizontal" and "vertical" bar graphs for clarification.

5. The tables here are only approximates and if the "ratio" idea seems confusing, see if it is more meaningful for anyone to use the following:

   When changing meters to yards, use meters x 1.1 = yards.

   When changing yards to meters, use yards ÷ 1.1 = meters.

   When changing liters to quarts, use liters x 1.06 = quarts.

   When changing quarts to liters, use quarts ÷ 1.06 = liters.

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6. It is suggested that two students make the phone calls in the event that one may be absent the following day, or that one may forget. Discuss the comparison of the two sets of data and decide which to use. It would be enlightening to note the difference between one whitewall tire and one blackwall. This may be of more interest to the boys than the girls. However, due to some poor business practices, it is advisable that girls know more about car problems and parts so as not to be so vulnerable to these poor business practices.

7. These activities are self-explanatory and no individual help should be required. It is merely interpreting the data from worksheet B-6a . If anyone discusses a front-end alignment, ask him to inquire about the cost, how often it should be done, and incorporate this into the tire cost.

8. (a) Have two students do the telephoning. These should be different students than those who did previous telephoning or writing letters so that these "involvements" are shared. Some stations don't charge a labor fee for changing oil, but an auto shop always does. This can be injected into your discussion. Decide which set of data is to be used, write it on the chalkboard and keep it available on the bulletin board (an actual sample included on TG 7.)

9. This reviews averaging and applying the data from 8(a) and should require no help.

10. For some cars, it is recommended that the oil be changed more often than 6,000 miles. Have the students inquire at home and discuss whether they want to change oil more often, then adjust the worksheet operation accordingly (when finding the cost per mile).

    The 16 miles per gallon is only suggestive; if someone feels another amount is more adequate, use it, but have everyone adjust the worksheet.

11. This is just applying data from worksheet B-8. The protractor must be cut out for use in making the circle graph. It might help for each expense to be expressed as a "fraction of the whole expense", then find that fraction of the 360° for each segment of the graph.

12. These figures are only suggestive. If someone wishes to find out from a reliable authority about what these figures should be, this would be motivating. How powerful the engine is determines a great deal what the miles-per-gallon are. The boys who are interested should be allowed to share their interest and knowledge. No help should be necessary to complete the activity.

13. There is a wide variation in the motel rates. To help interest, allow the students to make their own choice of a motel, particularly if they want one with a heated pool. However, for grading worksheets, it would be convenient if after some discussion the whole class could choose the same motel.

14. A brief discussion of dinner menus (favorites) and prices would add to the decision of a standard price for dinner. This worksheet can then be done independently. The standard price you choose for motel and dinner should also be written on the chalkboard and posted on the bulletin board.

15. This is just applying data from #14. The circle graph is not new.

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ANSWER SHEET

(Section B)

B-2 4 miles

B-2a. 1. 2
2. 4, 8
3. 50 inches
4. No
5. 2.5
6. Via Seaton
7. 6 miles
8. Greenville and Central City
9. Troy, Webley, Greenville

B-3a. 3 inches, 300 miles

B-4a. 1. 1.5 inches
3 inches
.75 inches

2. 200 miles
4.5 inches = 450 miles
3.75 inches = 375 miles

3-6. Answers will vary.

B-5b. 1. 400 meters
550 yards

2. 1.6 km.
1600 meters
1.6 km.

3. $\frac{100}{106}$, $\frac{106}{100}$

4. $4\frac{6}{25}$, $84\frac{4}{5}$

5. $\frac{5}{11}$, $\frac{5}{11}$, $9\frac{10}{11}$

B-6a. Answers will vary.

B-7a. Answers will vary.

B-8a. Answers will vary.

Price List (An Actual Sample)

Station	Reg. Gas 1 gal.	Prem. Gas 1 gal.	Oil 1 qt.	Oil Filter	Oil Change & Lub.
A	40¢	44¢	80¢	$4.75	$3.00
B	38.9¢	42.9¢	85¢	$4.50	$2.00
Total	78.9¢	86.9¢	$1.65	$9.25	$5.00
Average	39.5¢	43.5¢	82.5¢	$4.63	$2.50

B-9. 41¢. Addition and division

B-11a. Answers will vary.

B-12. 240 miles

B-13a. Answers will vary.

B-14a. $4 and $5.40
Remainder will vary dependent upon choices.

B-15a. Answers will vary.

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BACKGROUND NOTES

(For Cards C)

1-5. The enrichment worksheets are self-explanatory. C-5 response (one student only should write) could be shared on the bulletin board as well as discussed in class. C-4 should be great for reinforcing learning of coordinates in the Cartesian coordinate system in two dimensions. Students who work steadily should be rewarded with a game, but be aware of those who hurriedly finish - just to play. The commercial measuring wheel is available from the agent of McGraw Hill.

6. Rate times time equals distance $r \times t = d$, formulae used in solving simple algebraic word problems.

7. Student makes up his own scale to find distance between points, if given one distance on a map where the cities are closely approximated to the actual ones.

8. More on converting scales. If a scale is to be useful, it must be proportional; if it is, then the scale can be shown to be a straight line with the same slope at any point. Teachers may need to clarify or present different definitions of slope.

9. Crossword puzzle game involving the use of coordinates.

ANSWER SHEET

(Section C)

C-2b.
1. November
2. August
3. August
4. November

C-3.
$1.00
$2.00

C-6.
1 hour
1 hour 24 minutes

C-7b. Answers will vary, dependent upon which method is chosen.

C-8a.
a) 1 mile
.5 inches
4 miles
6 miles
2 inches

b. A straight line.

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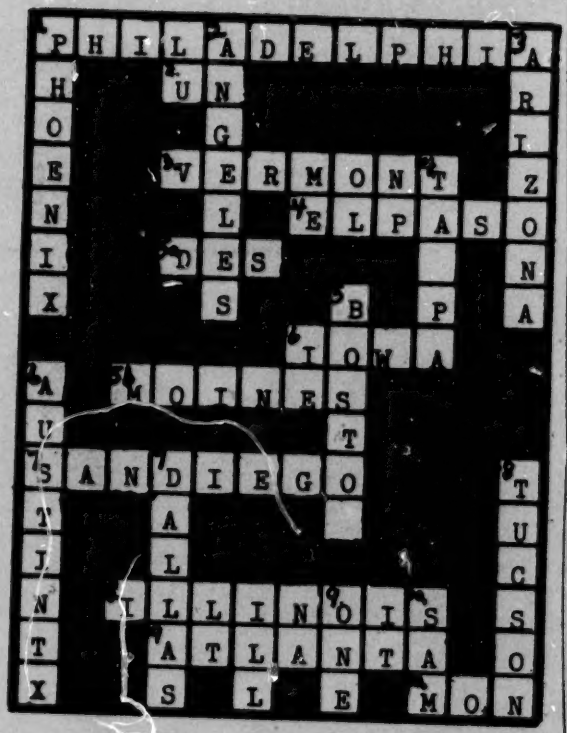
ANSWERS

ACROSS

1. Philadelphia
2. U.N.
3. Vermont
4. El Paso
5. Des Moines
6. Iowa
7. San Diego
8. Illinois
9. Atlanta
10. Mon



DOWN

1. Phoenix
2. Angeles
3. Arizona
4. Tampa
5. Boston
6. Austin Tx
7. Dallas
8. Tucson
9. One
10. Sam

Pretest

1. A circle = _____ degrees?

2. 2 = _____% of 6?

3. 1 meter = _____ yards?

4. How much do you think a set of radial tires (size G78 x 14) would cost? _____

5. What would you guess it costs to drive your family automobile per mile? _____

6. What do the food costs per day amount to per person while traveling? _____

7. If you must go 1206 miles and the plane fare is $210, what is the cost per mile? _____

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To make references easier, map-makers sometimes use imaginary horizontal and vertical lines to divide up the global earth.

The horizontal (→) lines are called parallels of latitude and the vertical (↑) lines are called meridians of longitude. These lines may be expressed either in degrees (°) or in time.

On A-1a, are the lines in degrees or in time? Where is this information located on the map?

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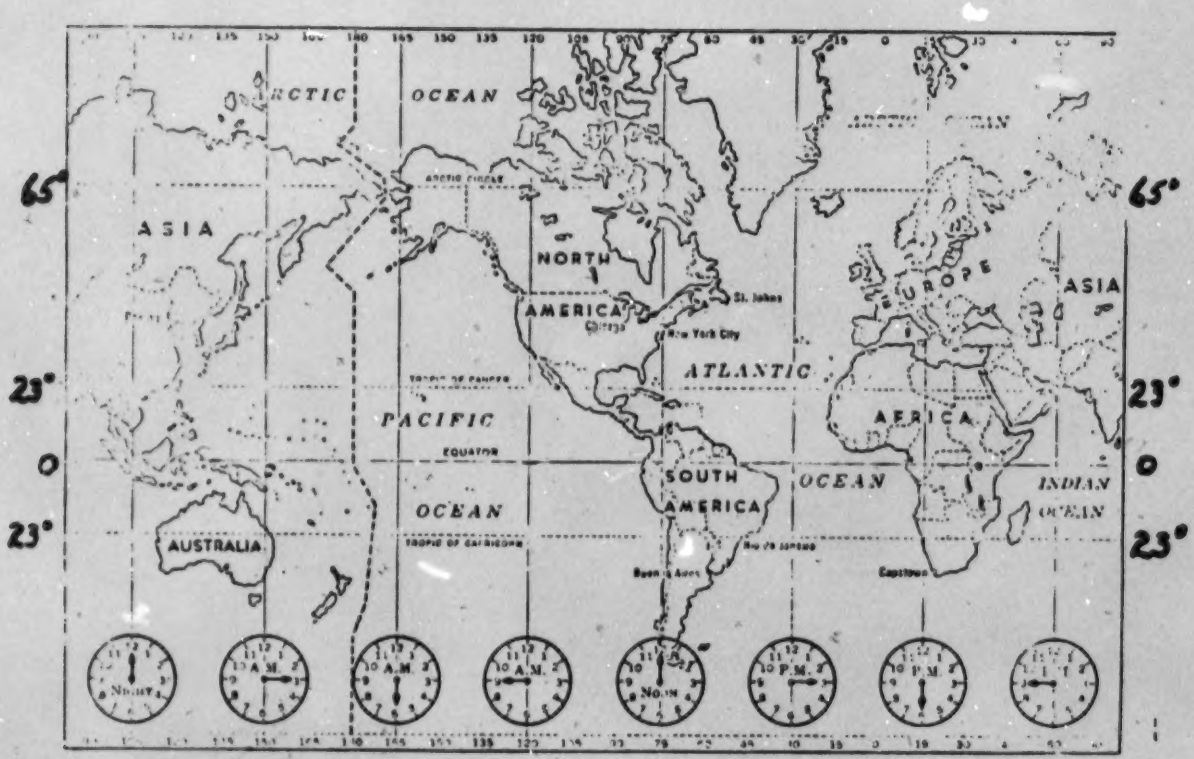
Map 1



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On map A-2a, find the seven cities listed on sheet A-2c. First find the parallel line (latitude) corresponding to the city, then find the meridian line (vertical) corresponding to the same city. Since cities may not lie exactly on two lines, you may have to estimate.

Put your answers on A-2c.

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Travel

A-2a

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Instead of having two columns on the worksheet for your answers for card A-2 , you could use only one column, column C. Since the parallels are in column A and the meridians in column B, you could use coordinate pairs (A,B) where A and B have the definite order of the parallel first, a comma, the meridian, then all enclosed in parenthesis.

In the space provided on A-2c, put the seven cities' parallels and meridians so that the cities can be expressed as coordinate pairs.

Another name for coordinate pairs, sometimes called coordinates, is "ordered pairs".

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City	A Parallel Degrees	B. Meridian Degrees	C. As Coordinate Pairs
1. New Orleans, Louisiana			
2. San Francisco, California			
3. Anchorage, Alaska			
4. Seattle, Washington			
5. London, England			
6. Julianehaab, Greenland			
7. Monrovia, Liberia			

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A number line has zero, negative and positive numbers going on infinitely in both directions, as indicated by the arrows. The packet contains two number lines. Lay the number lines on top of each other, then rotate the postive end of the yellow number line up from its straight position to the left, keeping the zero of the yellow line over the zero of the pink line. (Use a thumb tack or pin at the zeros, if necessary.) Rotate the lines to form a cross with four right angles.

With the lines in this cross position, use them to answer the questions on A-3a.

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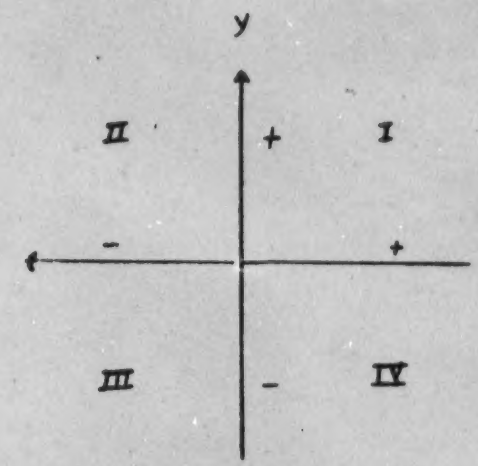
The x and y axes in the cross position make up a coordinate plane. In this position, the plane is divided up into four parts called quadrants, as in the sketch where the Roman numerals represent the four quadrants.



If the coordinate pairs of a point are both positive (x is positive, and y is positive), the point is in the I quadrant. Using this as a hint, answer the questions on A-4a.

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1. In what quadrant is a point where x is positive and y is negative?_____
2. In what quadrant is a point if x is negative and y is positive? _____
3. In what quadrant is a point if x is negative and y is negative? _____
4. Quadrant ____ and quadrant ____ are the two quadrants where x and y have like signs.
5. If x is zero and y is positive, between which two quadrants is a point?_____
6. If y is zero and x is negative, a point is between quadrants _____ and _____.
7. If y is zero and x is positive, between which two quadrants is a point?_____
8. If x is zero and y is negative, the point is between quadrants _____ and _____.

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Minneapolis
Reno
San Francisco
Chicago
Denver
St. Louis
Atlanta
Dallas
New Orleans
Brownsville

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Example:

City	Coordinates
Denver	(12, 13)

If a city lies on the y-axis, what must the x-coordinate be?

If a city lies on the x-axis, what must the y-coordinate be?

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Place grid A-6a over map A-6b so that the grid's origin corresponds to O_1 on the map. Determine which parts of the axes are negative and which are positive, then find the coordinate pairs for the 14 cities indicated with an asterisk on the map. The results should go on A-6c.

Now move the grid's origin over to the right so that it coincides with O_2 on the map. Determine and record on A-6c the coordinate pairs for this position.

Do the coordinates vary depending on the origin? Why or why not? Can you make any conclusions about the position of the origin?

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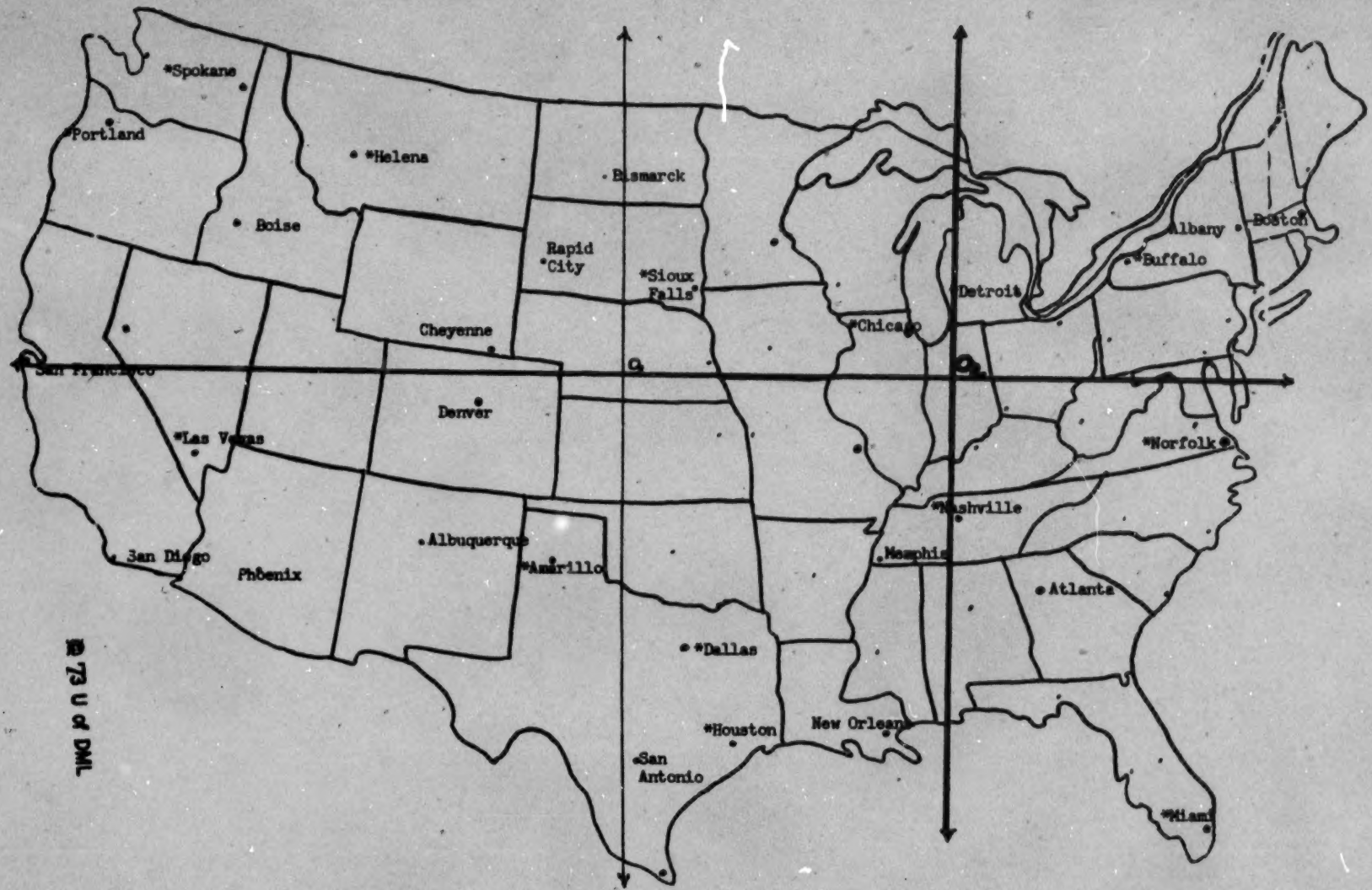

A-6b

Map of DWL

	A	B
City	Coordinates at Original Position	2nd Position
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		

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In a current Atlas, almanac or other reference, find the ten largest cities in population in the United States. List the cities in descending order; that is, the most populated first.

Record the cities, the population, and the reference used along with the year of the reference on A-7a.

Round off the results of the population to the nearest 100 thousand. Put this information under (B) on A-7a.

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City	(A) Actual Population	(B) Population rounded to nearest 100,000
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

References: _____

Year: _____

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Estimate the distance from Denver to the five cities listed on A-8a. Use map A-8b. Write your answers on A-8a under A.

Using table A-8c, find the air mileage from Denver to the same cities. Record these mileages on A-8a under B.

This table should give better results than your estimates. Does it? Why or why not?

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Cities	Miles from Denver	
	Estimated - A	Actual - B (From Table A-8c)
1. Atlanta		
2. Boston		
3. Memphis		
4. Seattle		
5. San Diego		

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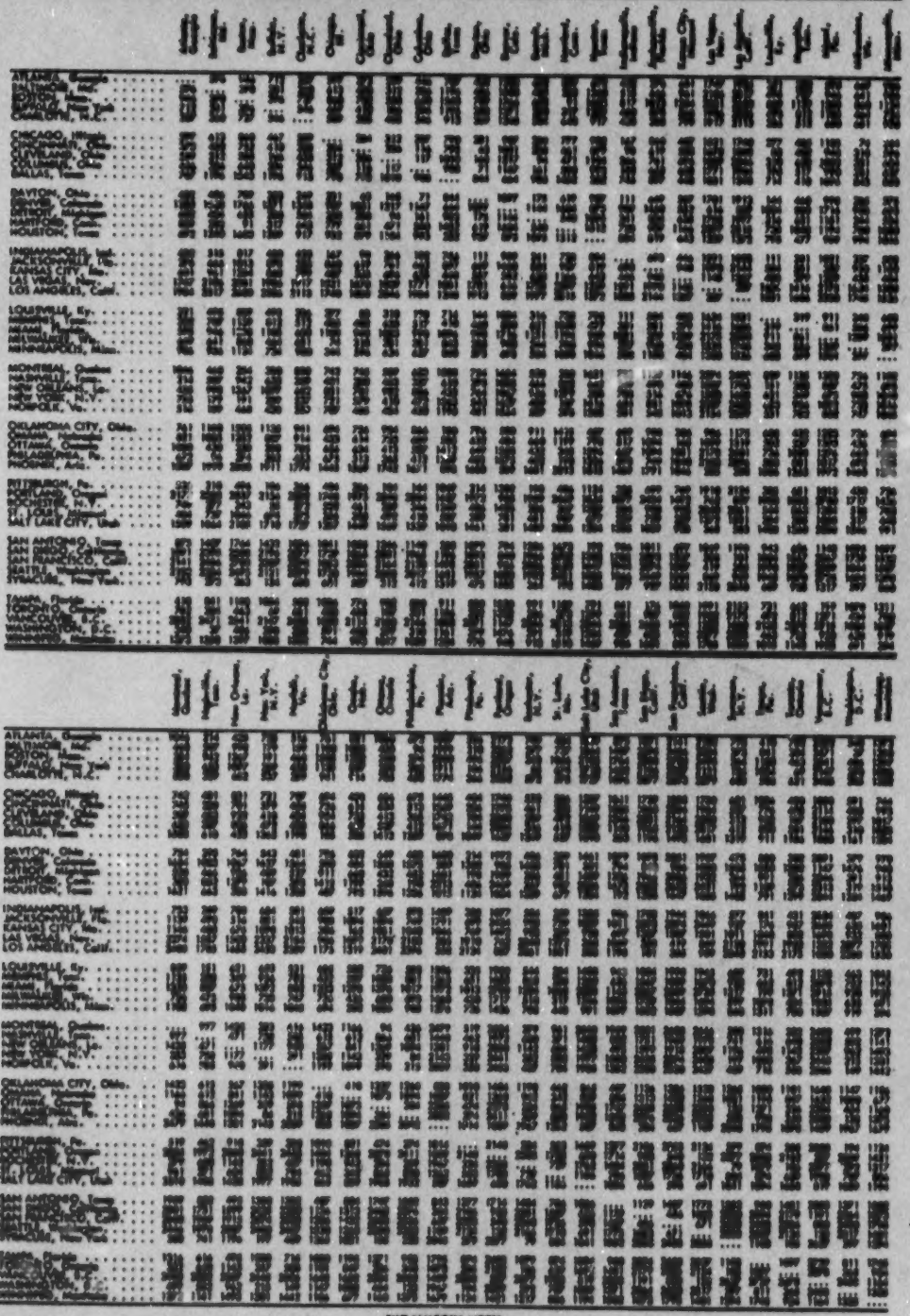
A-8b

U.S. and CANADIAN DOMESTIC AIRLINE MILEAGES



EXPLANATORY NOTES

Use a bar graph to show the actual air mileages from Denver to the five cities on A-8a. Let the x axis represent the cities and the y axis represent the miles. You will have to determine how to divide up the y axis for the miles.

Graph on A-9a.

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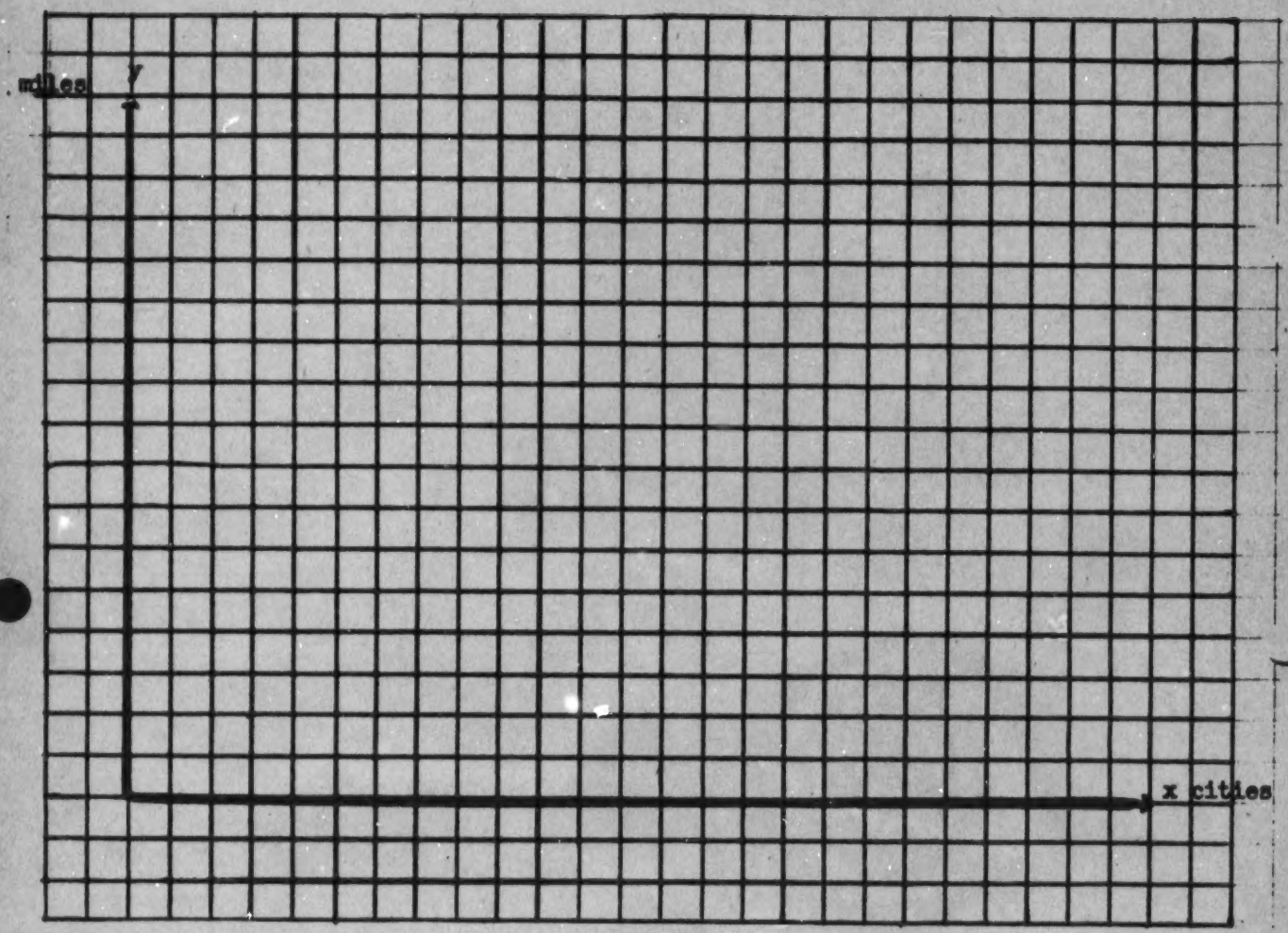

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Call or write two different airline companies and find the one-way plane fare to five cities from an airport near your home. Ask for cost of first class, coach, economy, stand-by, and other.

Compare the cost of different type tickets.

Compare the two different airlines.

Can you conclude anything?

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COMPARING CLASSES

Cities		1st Class	Coach	Economy	Stand-by	Other
1.	Airline Co. #1					
	Airline Co. #2					
2.	Airline Co. #1					
	Airline Co. #2					
3.	Airline Co. #1					
	Airline Co. #2					
4.	Airline Co. #1					
	Airline Co. #2					
5.	Airline Co. #1					
	Airline Co. #2					

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Using a bar graph, show the first-class fare; then next to it, the coach fare for each of the five cities on A-10a. Use the graph provided on A-11a.

How much of the first class fare for either airline can be saved traveling by coach? First estimate from the graph on A-11a, then compute using the data from A-10a. Space for answers is provided on A-11b.

What percent (%) of the first-class fare can be saved by traveling in coach, using the actual fares? Record the answers on A-11b.

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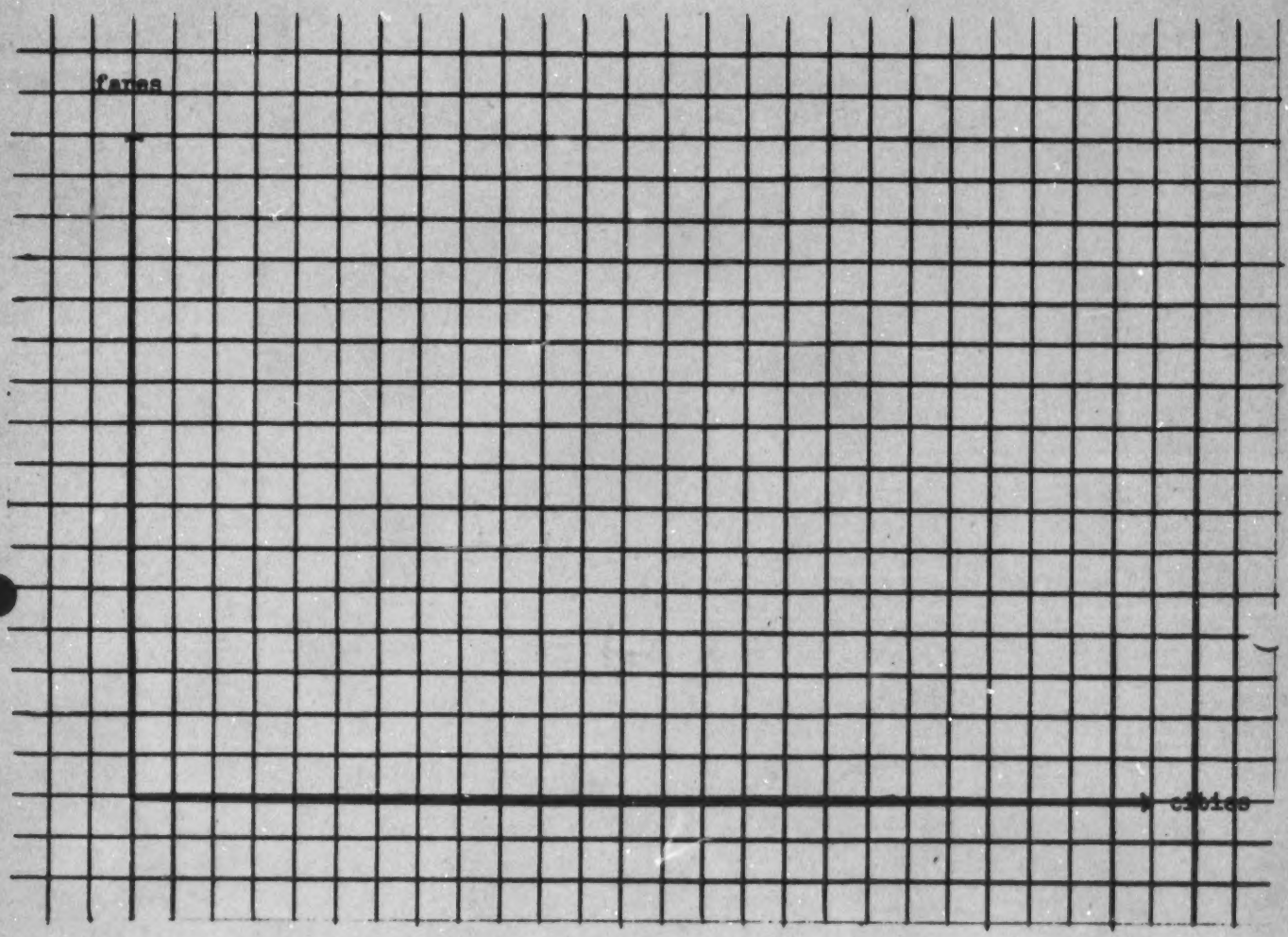

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City	Estimated Amount Saved	Actual Amount Saved	Actual % Saved
1.			
2.			
3.			
4.			
5.			

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Make a line graph of the one-way fares (first class) to the five cities you listed on A-11b.

Graph the coach one-way fares, using a different colored pencil. Use the graph on A-12a.

Can you conclude anything about or from these graphs?

What do you think would be some of the advantages and disadvantages in flying first class?

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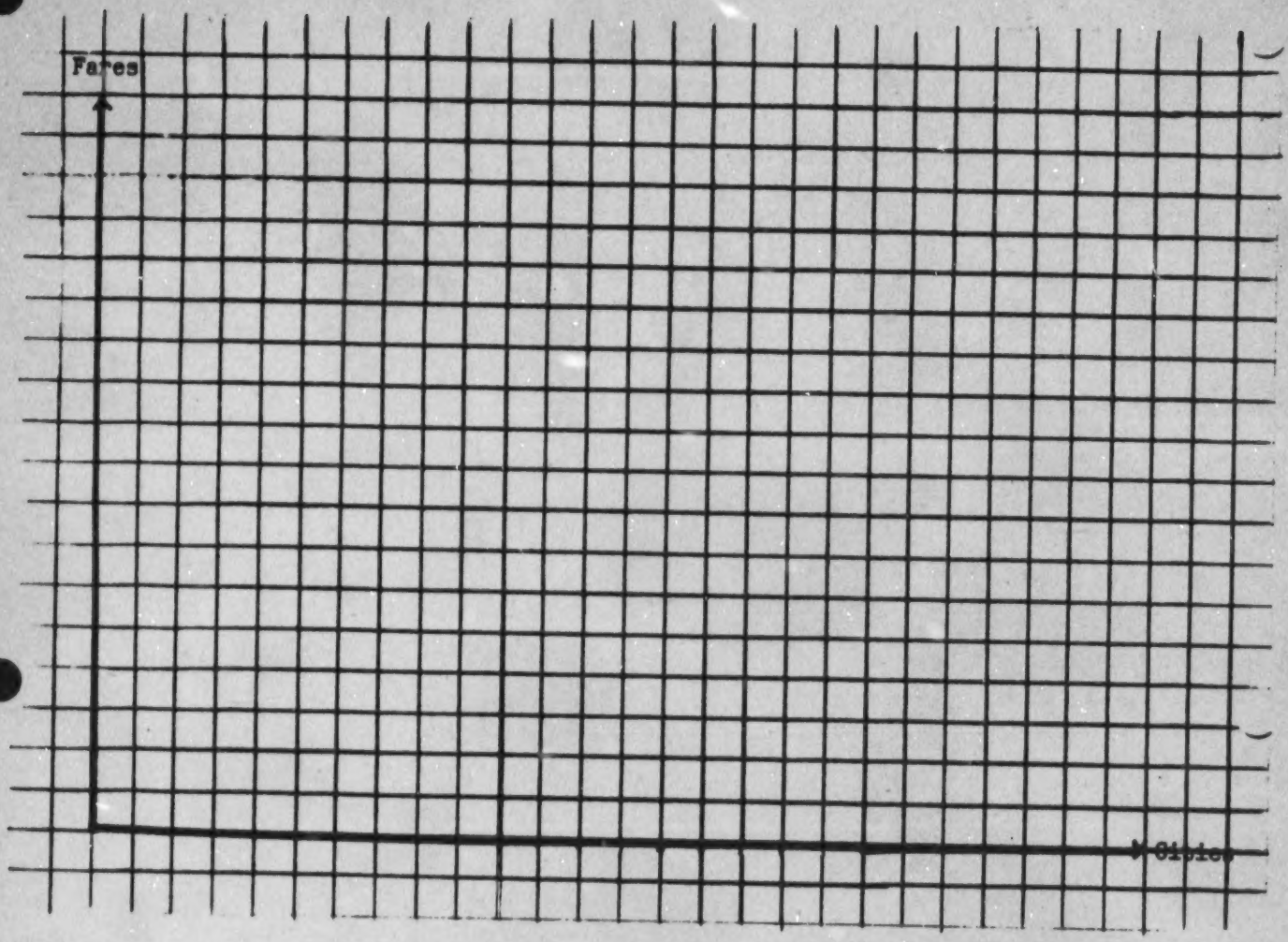

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Find the cost per mile traveling by first class and by coach, from the airport near you to the cities listed on A-10a. You may need to refer to table A-8c. The / represents per.

Record the results and fill in the additional information on A-13a.

Can you summarize a way of determining the cost per mile in a formula? What would it be?

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City	Miles from Denver	1st Class Cost from Denver	Coach Cost from Denver	1st Class Cost/mile	Coach Cost/mile
1.					
2.					
3.					
4.					
5.					

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Use A-13a and construct a horizontal bar graph of the coach cost per mile to each of the cities listed.

Determine the divisions for the cost per mile. Use A-14a.

Is the cost proportional to the distance traveled? That is, is the cost per mile about the same for each city?

Is it always true that the greater the distance, the more the fare? Can you find any exceptions?

What could be some of the advantages and/or disadvantages an airline would have in flying to a larger city as compared to a smaller city?

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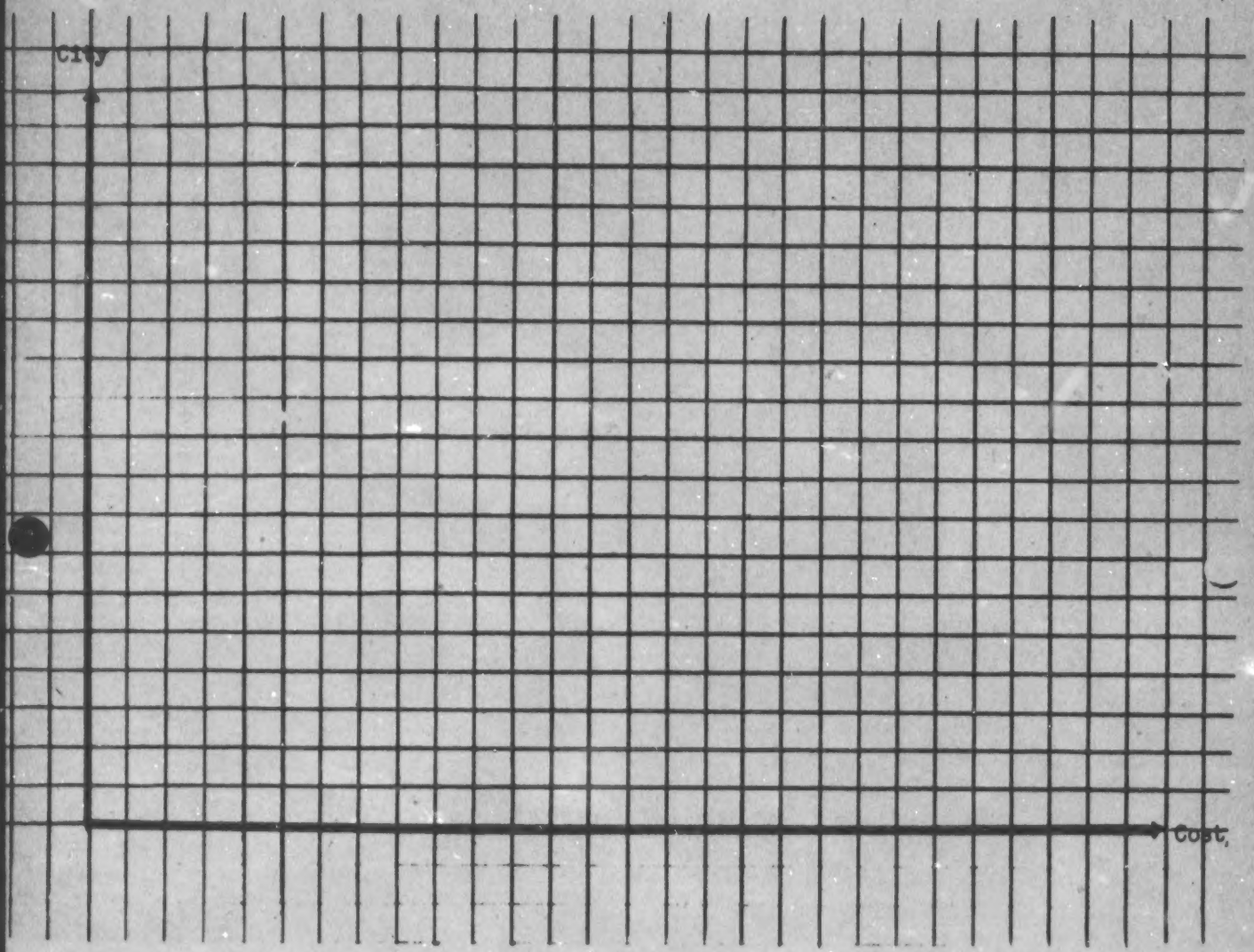

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If a plane can average 500 mi./hr., could you estimate how long it would take in hours and minutes to arrive at the cities you listed on A-8a? Put your answers on A-15b.

If you leave the airport near your city at 8:00 a.m. and go to each of the cities listed on A-8a, what is the local time upon arrival at each city? Use the time zones on map A-15a.

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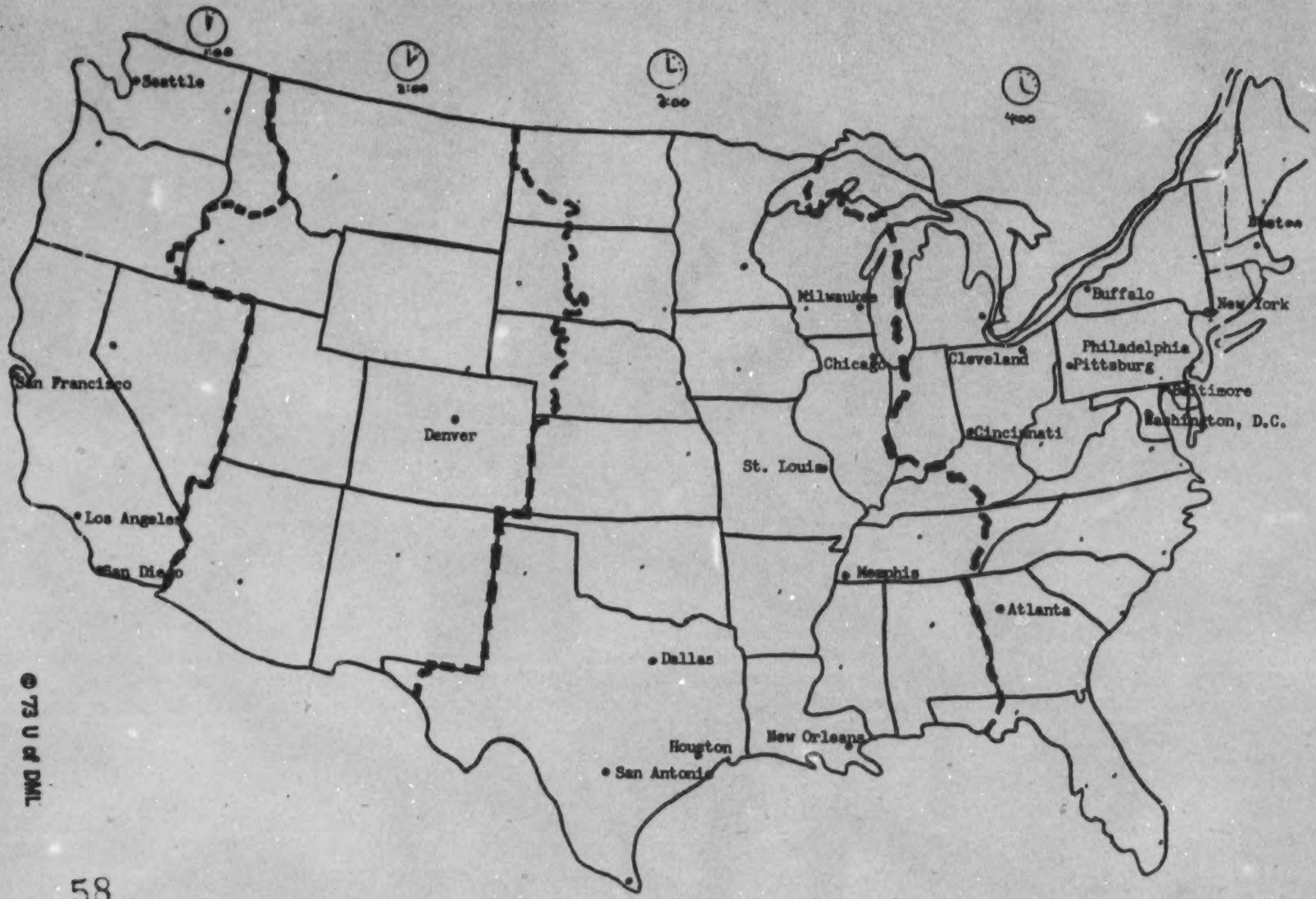

A-15a

© 73 U of DMI

City	Miles from Airport near you	Time in Hours and Minutes	Arrival Time (Local)
1.			
2.			
3.			
4.			
5.			

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Did you know that there are 115 youth hostels in the United States where you can stay for about $2 per night, if you are a member? Write to:

American Youth Hostels, Inc.
20 W. 17th Street
New York, NY 10011

requesting:

(1) an application form
(2) membership rates
(3) regulations
(4) locations of hostels in the U.S.
(5) information about training for guides (a possible free trip)
(6) schedules of hosteling trips in and outside of the U.S.

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When you travel by automobile, it is important to know how to read a map. The legend helps you to read one. It has a distance scale of 1/4 inch = 1 mile, 1 inch = _____ miles.

See how well you can read the map on B-2a and fill in the blanks. Measure the mileage scale first.

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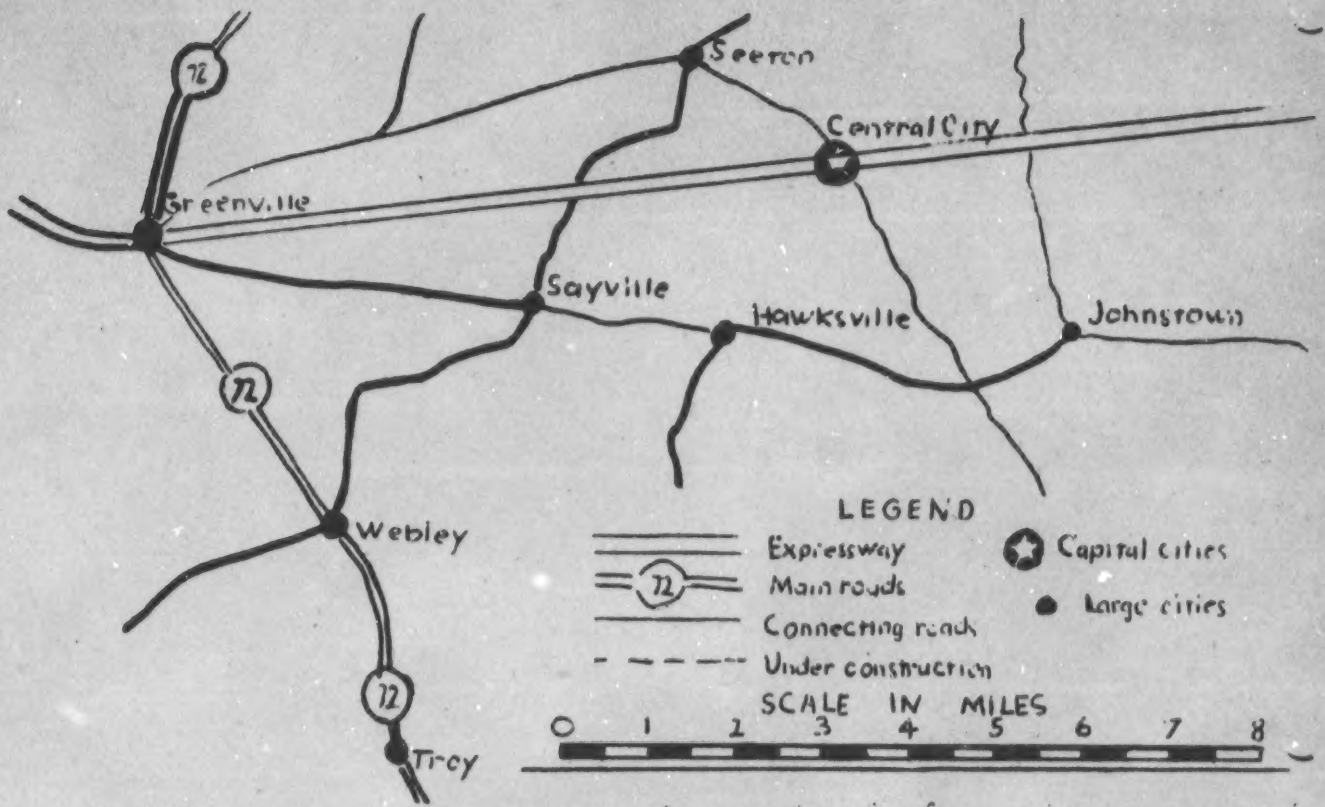
Here is a map of part of a make-believe state.



1. The scale in miles is _____ miles per inch.

2. Greenville is _____ inches from Central City; therefore, it is really _____ miles.

3. If you lived 100 miles from Central City, how many inches would that be on the map? _____

4. Is your map large enough to show your home? _____

5. How many miles of road are under construction? _____

6. Suppose you cannot travel on a road that is under construction. What route would you take from Sayville to Central City?

_____

7. About how far would that be in miles? _____

8. What cities does the expressway go through? _____

9. What cities does the main road go through? _____

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Assemble the measuring wheel, B-3a, or use a commercial measuring wheel. If one revolution of the measuring wheel is 1-1/2 inches, what distance does two revolutions cover?

Using a map scale of 1 inch = 100 miles, how many miles would two revolutions cover?

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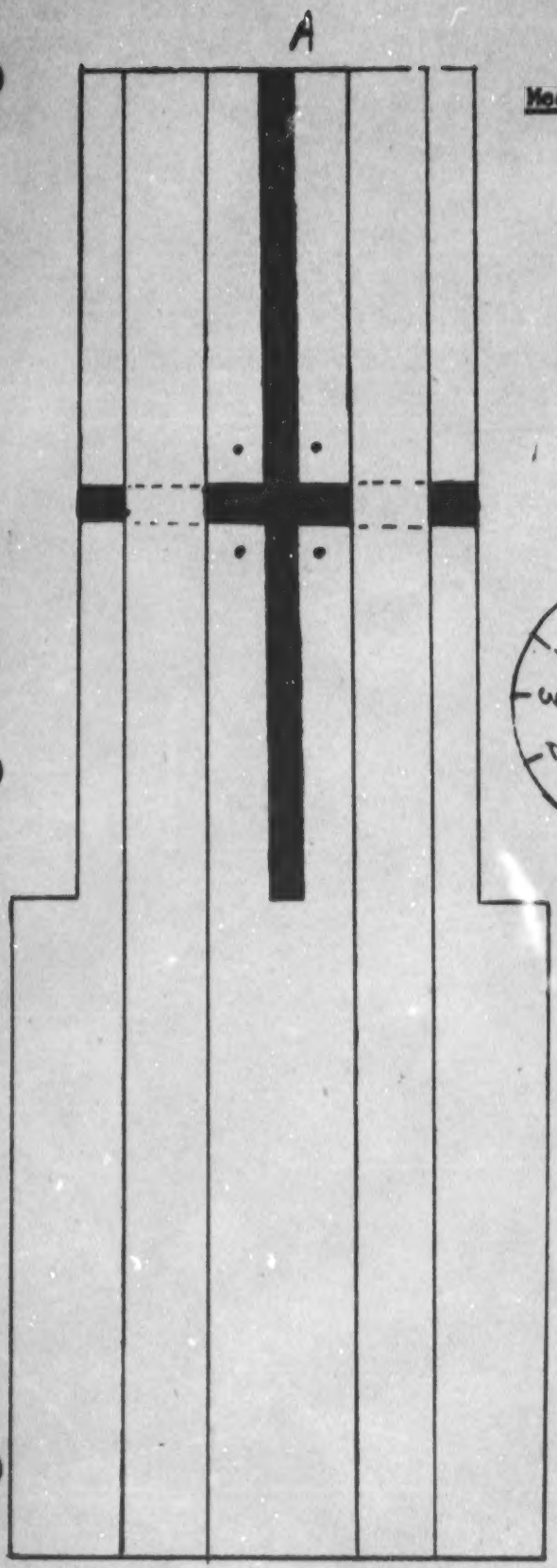
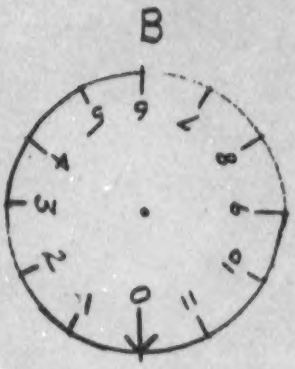
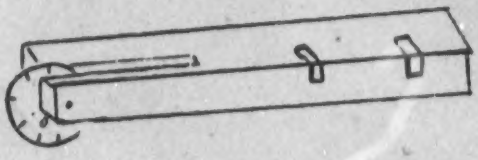
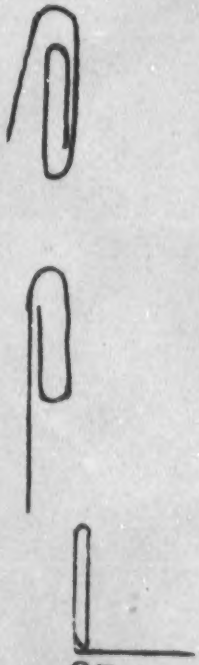


Measuring Wheel

1. Cut out A and B.
2. Cut out and remove all shaded areas.
3. Fold on all lines
   a. solid lines first
   b. dotted lines
4. With a pin make holes at the four dots.
5. Assemble as shown.







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Choose a place on your United States road map where you would like to spend a vacation. Looking at the map legend to get your mileage scale, estimate, without measuring, what the distance would be in miles. Remember, we never expect an estimate to be exact. Record this on worksheet B-4a, question 3. Now use the measuring wheel to measure the distance, record it, then convert it to miles on the same worksheet.

Now, using a horizontal line, graph

(1) your estimate of the distance B-4a, question 3

(2) the actual distance.

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1. Place the measuring wheel on the line below, with the arrow on the starting point. Turn the wheel along the line one complete revolution and mark the end point.

   start ├──────────────────────────────

   Now measure the distance with your ruler.

   one turn = _____ inches

   two turns = _____ inches

   one-half turn = _____ inches.

2. If your map scale reads 1 inch = 100 miles,

   2 inches = _____ miles

   3 turns = _____ inches = _____ miles

   2½ turns = _____ inches = _____ miles.

3. Your estimated distance in miles from your city to your chosen city is _____.

4. (a) _____ turns of the measuring wheel will determine the distance in question 3.

   (b) Convert this to inches; i.e., (turns) x (inches/turn) = _____ inches.

   (c) Using your answer to 4b, convert this distance to miles; i.e., inches x miles/inch = _____ miles.

5. If there is some other way, such as adding up distances or using a mileage chart, find the actual mileage. _____ (If not, omit #5)

6. What is the difference between your estimate and that obtained with the measuring wheel? _____

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In the event that we may sometime convert to the metric system, which is based on our decimal system and is easy to learn, would you know how a few basic units compare to our current measuring system? Using the scales and comparisons on B-5a, which are approximates only, complete worksheet B-5b.

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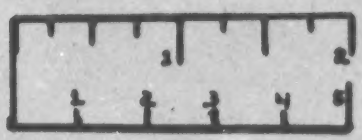
METRIC SYSTEM UNITS

INCHES
CENTIMETERS



1 DECIMETER = .1 METERS

1 CENTIMETER = .01 METERS

1 MILLIMETER = .001 METERS

1 METER = 1.1 YARDS

1 LITER = 1.06 QUARTS

1000 GRAMS = 1 KILOGRAM

1 KILOGRAM = 2.2 POUNDS

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1. One meter = 1.1 yards

   Ten meters = 11 yards

   Since 10 and 11 are easy numbers to work with, we can use them as a ratio 10:11 when converting meters to yards. We can express this as a fraction to make it easier still and our formulas would be meters.

   meters x $\frac{11}{10}$ = yards

   yards x $\frac{10}{11}$ = meters

   Now can you convert these distances:

   440 yards = _____ meters

   500 meters = _____ yards

2. European road distances are measured in kilometers instead of miles.

   1 kilometer = 1000 meters

   1600 meters = _____ kilometers

   one mile = 1760 yards = _____ meters

   = _____ kilometers

3. 1 liter = 1.06 quarts

   100 liters = 106 quarts

   We can express this as a ratio 100:106.

   Can you form the fraction you would use to make the following conversions?

   liters x _____ = quarts

   quarts x _____ = liters

4. 1 gallon = _____ liters

   If your car holds 20 gallons of gas, how many liters is that? _____

5. 1000 grams = 1 kilogram = 2.2 lbs.

   so 10 kilograms = 22 lbs.

   What is the ratio of kilograms to lbs.? _____

   What is the conversion fraction used in changing kilograms to lbs.? _____

   It is the reciprocal that we use to change lbs. to kilograms or _____.

   If your tires need 20 lbs. of air each, how many kilograms of air is this? _____

6. Using a bar graph, show how (1) a pound compares with a kilogram and (2) a mile compares with a kilometer.

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Suppose your family is taking a vacation by automobile and you need a new set of tires. Telephone three places where you can buy tires; i.e., a large department store, a service station, and a tire firm. Ask their price and the mileage expected for the following types of tire in size G78 x 14:

1. radial tire
2. bias ply tire
3. belted bias tire.

Be sure to get a breakdown of the prices (federal and local tax) and record these on worksheet

Now you have three different prices of a radial tire, bias ply tire, and a belted bias tire. Add the three prices for each kind of tire and find the average price. Record this on worksheet B-6a.

Now find the cost per mile for <u>one</u> tire and record this on worksheet also.

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Size G78 x 14	Dept. Store Price	Service Station Price	Tire Company Price			
Radial tire Federal tax Local tax						
Total				Average Price	Miles Expected	Cost/ Mile
Bias ply tire Federal tax Local tax						
Total				Average Price	Miles Expected	Cost/ Mile
Belted bias tire Federal tax Local tax						
Total				Average Price	Miles Expected	Cost/ Mile

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Usually you get only what you pay for, yet there is a great deal of difference in the prices of tires. Using your average price for each kind of tire from worksheet B-6a, find the cost of:

a) four radial tires
b) four bias ply tires
c) four belted bias tires.

Using a vertical bar graph and your own scale, show the cost for a, b, and c on worksheet B-7a.

Using the cost per mile for one tire on worksheet B-6a, find the cost per mile for four

a) radial tires
b) bias ply tires
c) belted bias tires.

Show this on a horizontal bar graph on worksheet B-7a.

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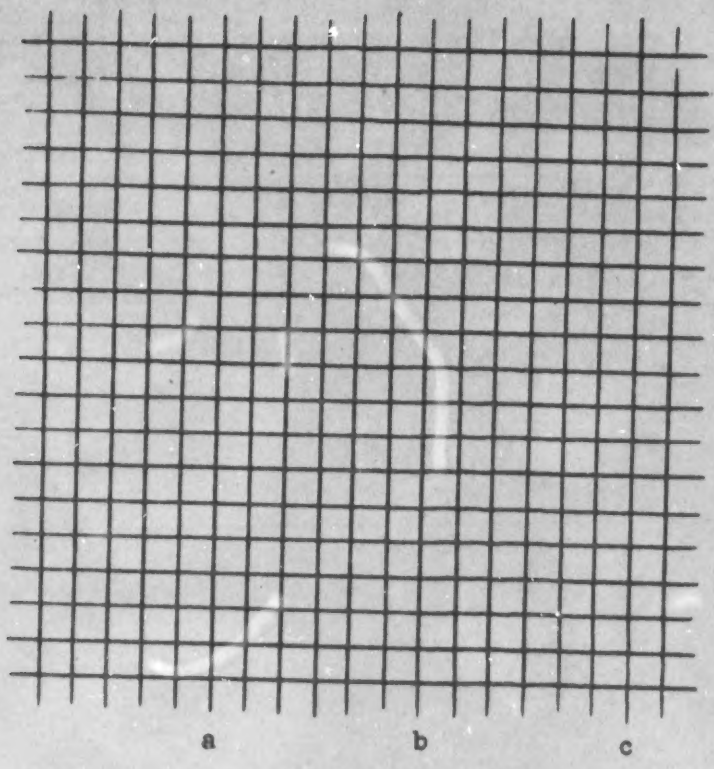
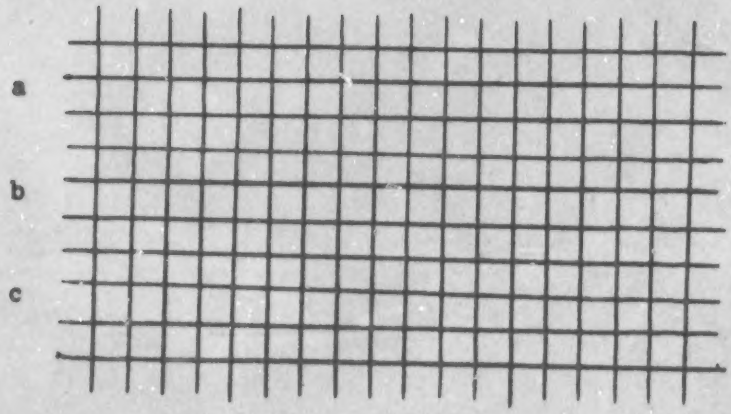


Cost of tires (4) graph



Cost per mile graph

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As a part of your motoring expenses, you need to know a variety of costs. Telephone two service stations for the following prices:

1. One gallon of regular gasoline
2. One gallon of premium gasoline
3. One quart of oil
4. One oil filter
5. Labor charge for the oil change, and cost of lubricating the necessary parts.

Record this information on worksheet B-8a.

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	Regular Gas 1 gal.	Premium Gas 1 gal.	Oil 1 qt.	Oil Filter	Oil Change & Lubrication
Station A					
Station B					
Total					
Average					

* (a) Oil change, 5 qts. _____

(b) Added oil, 2 qts. _____

* (c) Cost of oil filter _____

* (d) Cost of lubrication _____

(e) Total cost _____

(f) Cost per mile _____

(g) Cost per mile _____

*Oil should be changed every 6,000 miles, along with a new filter.
Car should be lubricated every 2,000 miles.

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If one service station charges 40¢ per gallon for gas and another charges 42¢ per gallon, what is the average of the two prices? What two fundamental operationsdid you use to get your answer? Using the prices you recorded on worksheet B-8a, find the average of two prices for the following:

1. One quart of oil
2. One oil filter
3. One oil change and lubrication
4. One gallon of premium gasoline
5. One gallon of regular gasoline.

Record these on worksheet B-8a. If your average price includes a fraction of a cent, use the next whole cent.

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Most cars should have the oil changed every 6,000 miles and you may have to add some oil in between changes. If your car requires five quarts of oil and you had to add two quarts, what is the total cost of: (using the average price from worksheet)

1. oil in change
2. oil added
3. oil filter
4. labor and lubrication.

This takes care of your oil needs for 6,000 miles. What is the cost per mile? Record your answers on worksheet B-8a , line (f).

Suppose you get 16 miles per gallon of gasoline. Using your average price per gallon for regular gasoline from worksheet B-8a, what is your cost per mile for gasoline? Record this answer on worksheet B-8a, line (g).

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Using the cost per mile for:

1. four radial tires from worksheet B-7a
2. oil from worksheet B-8a, line (f),
3. gas from worksheet B-8a, line (g),

what is the total cost per mile for tires, gas, and oil? Record this on worksheet B-11a.

Using a circle graph, show how much of the cost per mile is for:

a) gas
b) oil
c) tires

from the data on worksheet B-11a. Remember a circle has 360°.

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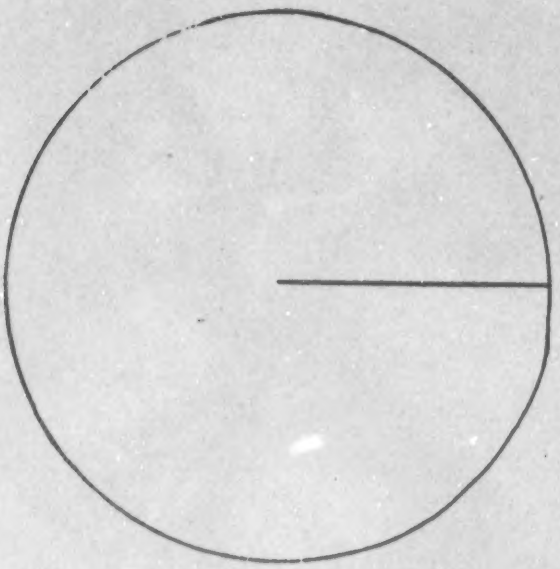
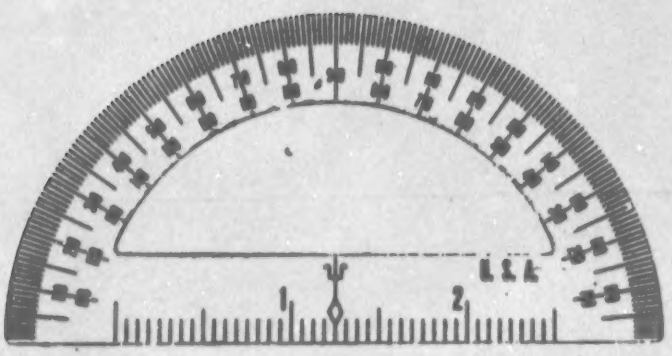
Cost per mile for four radial tires _____

Cost per mile for oil (filter & lube) _____

Cost per mile for gas (regular) _____

Total cost per mile _____





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Stopping and starting in city driving cuts down on the number of miles per gallon you get.

If you get 12 miles per gallon while city driving, how many miles can you expect to get from a 20-gallon tank of gas?

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From the motels and rates chart, choose a motel with accommodations for four.

(a) Enter this on worksheet B-13a.

(b) One quarter of this amount is the cost per person.

(c) At the same motel, find the rate for one person travelling alone. Enter that amount on worksheet B-13a.

(d) Using a vertical bar graph, show how (b) compares to (c).

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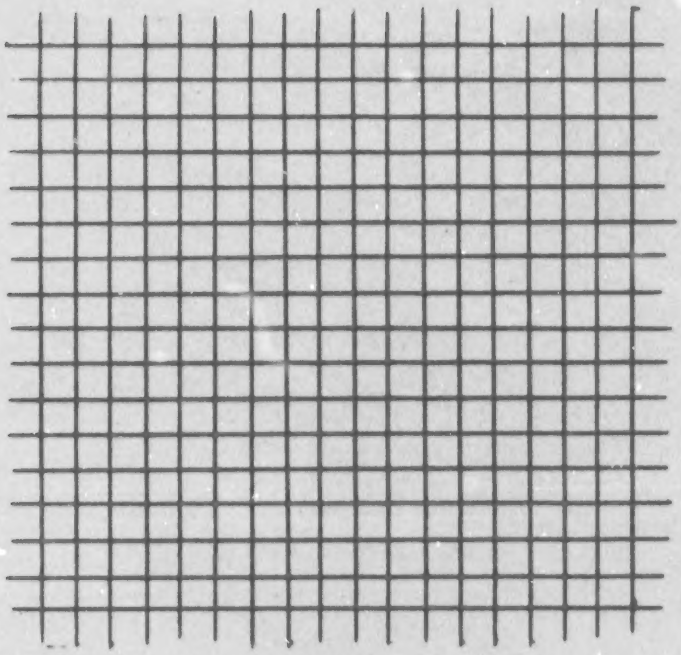
(a) Motel accommodations for four _____ (one night).

(b) One quarter of this amount is _____.

(c) Motel accommodations for one person travelling alone is _____.

(d) By means of a vertical bar, show (b) and (c).



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IN-SEASON RATES ONE ROOM (Effective Dates)	One Person	Two Persons One Bed	Two Persons Two Beds	Three Persons	Four Persons

BEAVER (Continued)

Sleepy Lagoon Motel 17 units — Very Good
● 5/15-9/15 ..... 12.00 12.00– 14.00 15.00– 17.00 17.00– 18.00 16.00– 20.00
One-half mi. s. of US 91. Spacious grounds. Attractively furnished units; air cooling or A/C; TV; comb. or shower baths. Six new units. Phone (801) 438-5681. BA, MC.

BICKHILL (84715)—364

Sunglow Motel 18 units — Very Good
● 5/1-10/1 ..... 7.00 ..... 10.00 ..... 12.00 ..... 14.00 ..... 16.00
Center on SR 24. Attractively decorated units; A/C; comb. baths. One efficiency kitchen. Phone (801) 425-3821. BA, MC.
● Restaurant; 6 a.m. to 10 p.m.; dinners about $1.50 to $3.

BLANDING (84511)—2,250

Gateway Motel 33 units — Good
● All year 7.00 8.00– 9.00 10.00– 12.00 12.00– 14.00 12.00– 14.00
E. side on SR 47. Comfortable units; most A/C; TV; some phones; shower baths. Phone (801) 678-3531. BA.

BLUFF (84512)

Recapture Lodge 10 units — Good
● All year 6.00– 8.00 8.00– 9.00 10.00– 12.00 11.00– 13.00 14.00– 16.00
W. side on SR 47. Air cooling; shower baths. Two kitchens, $1 extra. Restaurant opposite. Heated pool. Playground. Laundry. Geologist-guided tours; one-day river trips. Airport pickup service. Pets. Phone (801) 672-2281. BA.

BOUNTIFUL (84010)—37,883

Bratton's Seafood Cove—on US 91, midway between Salt Lake City & Ogden, at 1385 S. 500 West St. A/C. Pleasant dining atmosphere. Dinners about $2.70 to $7.25. Children's menu. Open 11 a.m. to 10 p.m.; closed Sundays. Phone (801) 295-2384.

BRIGHAM CITY (84302)—14,887

Bay View Motel 30 units — Very Good
● 5/1-10/1 9.00– 10.00 11.00– 12.00 14.00– 15.00 15.00– 16.00 16.00– 17.00
S. side of US 89 & 91, at 1167 S. Main. Attractively furnished rooms; A/C; TV, most color; ■ phones, shower baths. Pool. Phone (801) 723-8511. AE, BA, CB, DI, MC. *Member Friendship Inns.*

Westward Ho Motel 17 units — Good
● 5/1-10/1 ..... 10.00 ..... 12.00 14.00– 16.00 14.00– 17.00 ..... 18.00
5 blks. N. of center, at 505 N. Main St. Neatly furnished units; air cooling; TV; phones; comb. or shower baths. Phone (801) 723-8584. BA, CB, MC, AO, PH. *Member Best Western.*

BRIGHTON (84117)

Mount Majestic Manor 25 units — Good
All year ..... 12.00 ..... 16.00 ..... 16.00 ..... 22.00 ..... 22.00
Comb. or shower baths. Some dormitory rooms share bath, $5 to $6 per person. One suite. Ski packages.
● Dining room and coffee shop; meal hours summer 10 a.m. to 9 p.m.; during ski season 9 a.m. to 7 p.m.; dinners about $3.75 to $5.50.

Silver Fork Restaurant—3 mi. w. of Brighton; 12 mi. from mouth of Big Cottonwood Canyon. Beautiful setting. Large, nice dining room with fireplace. Coffee shop. Deliciously served food. Open 9 to 10 p.m.; Sundays to 8 p.m. Dining room closes at 8 p.m. in winter months. Closed April 3 to May 1. Phone (801) 1-649-9551.

BRYCE CANYON NATIONAL PARK

Bryce Canyon Pines 10 units — Very Good
● 5/15-9/15 8.00– 10.00 9.00– 12.00 10.00– 16.00 11.00– 16.00 12.00– 18.00
On SR 12; 3 mi. e. of summit of Red Canyon, 6 mi. from park entrance. (P.O. Panguitch, 84759.) Attractively furnished rooms; some color TV; 2 fireplaces; shower or comb. baths. One efficiency, no utensils. Horses available in season; extra charge. Pets. Phone (801) 834-9280. AE, BA, MC.
● Coffee shop; 7 a.m. to 10 p.m.; dinners about $1.75 to $5.

Pink Cliffs Motel (84717) 29 units — Very Good
● 3/15-11/15 ..... 10.00 ..... 14.00 ..... 16.00 ..... 18.00 ..... 18.00
At jct. of SR 12 & 22; 2 mi. n. of park entrance. Twenty new units in a one- and two-story ■ motel. Extra-size beds. Two units specially designed for handicapped persons. A/C, TV; music; phones; comb. or shower baths. Laundromat. Pets. Nine nicely furnished older units. A/C; or air cooling. Phone (801) 834-5355. AE, BA, DI, MC, MB. *Member Friendship Inns.*
● Restaurant; 7 a.m. to 9:30 p.m.; dinners about $2.75 to $5.

Ruby's Inn 33 units — Very Good
● 4/1-11/30 12.00– 16.00 12.00– 16.00 16.00– 18.00 16.00– 20.00 18.00– 20.00
On SR 12, 1 mi. n. of Bryce Canyon National Park entrance. (P.O. Ruby's Inn, 84764.) Two-■ story motel. Tastefully decorated rooms; 4 with electric fireplaces; phones; TV; comb. or shower baths; most extra-size beds. Laundromat. Pets. Restaurant adjoining, Horseback trips available to nearby waterfall. Phone (801) 834-5239. AE, BA, MC, TX.
● Restaurant and coffee shop; meal hours 7 a.m. to 10 p.m.; dinners about $2 to $5.

CAPITOL REEF NATIONAL MONUMENT

Sleeping Rainbow Guest Ranch 11 units [A] — Very Good
● 5/1-11/1 ..... 30.00 ..... 40.00 ..... 60.00 ..... 80.00
Secluded guest ranch along Pleasant Creek; 11 mi. s. of the Visitor Center, in a picturesque park setting. (P.O. Box 93, Torrey, Utah 84775.) Tastefully furnished units A/C and air cooling; comb. or shower baths. Delicious family-plan meals. Guided tours. Open May 1 to Nov. 1. Phone long distance operator Moab, Utah exchange; ask for JL 7-5167.

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The motel rates chart includes some dinner prices but no breakfast and lunch prices. If each member of a family of four pays $1 for breakfast and $1.35 for lunch, how much does breakfast and lunch for four cost? From the prices listed, choose a dinner price and total breakfast, lunch, and dinner for four people. If your tip is 10%, what is the cost of meals and tips for one day? Record your answers on worksheet B-14a.

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(a) Breakfast for one is $1.
Breakfast for four - 4 x $1 = _____.

(b) Lunch for one person is $1.35.
Lunch for four persons - 4 x $1.35 = _____.

(c) Dinner for one person is _____.
Dinner for four persons - 4 x _____ = _____.

(d) All meals for four persons for one day = _____.

(e) 10% of (d) to cover tips = _____.

(f) Cost of meals and tips = _____.

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1. Transportation
   a) cost per mile _____(from worksheet B-11a)
   b) cost per 300 miles = _____.

2. Motel accommodations for four for one day _____(from worksheet B-13a)

3. Meals for a family of four for one day _____ (from worksheet B-14a)

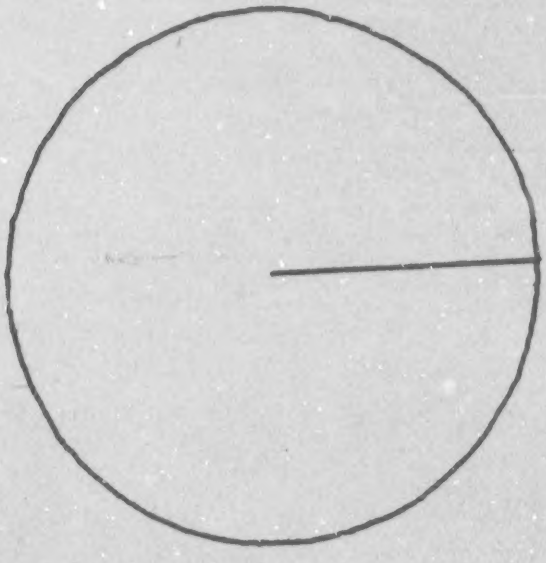
4. Total costs for one day (1(b) + 2 + 3) _____.

5. Transportation is what percent of the total cost?_____

6. Motel accommodation is _____% of total.

7. Meals are _____% of the total cost.

8. Show 5, 6 and 7 on a circle graph.



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If your water bill is $12 each month, how much should it cost for one week? _____ (Use four weeks for one month.)

If your food (including groceries, school lunches, and eating out) costs $200 each month, how much should it cost for one week? _____

If your rent or house payment is $180 per month, how much should one week's housing cost? _____

On worksheet C-1a, keep a record for one week of the expenses indicated. Compare it to a week's travel expenses by completing worksheet C-1a.

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One weeks expenses at home

Lodging	Food, Groceries, etc.	Transportation Bus & Car Cost
Total		

1. Total expenses _____
2. One day's travel expenses (from worksheet B 15a) _____
3. Seven days travel expense _____
4. One week's travel expense is how many times as great as one week's home expenses? (In these areas) _____

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From the temperature averages chart, record the minimum average temperature for one year for the city of Douglas, Arizona, by using a point graph and setting your own scale (you might let 1 inch = 25°). Join these points from January through December.

Which month shows the greatest difference between the average high and the average low? Which month shows the least difference?

Enter your answers on worksheet C-2b and complete questions 3 and 4.

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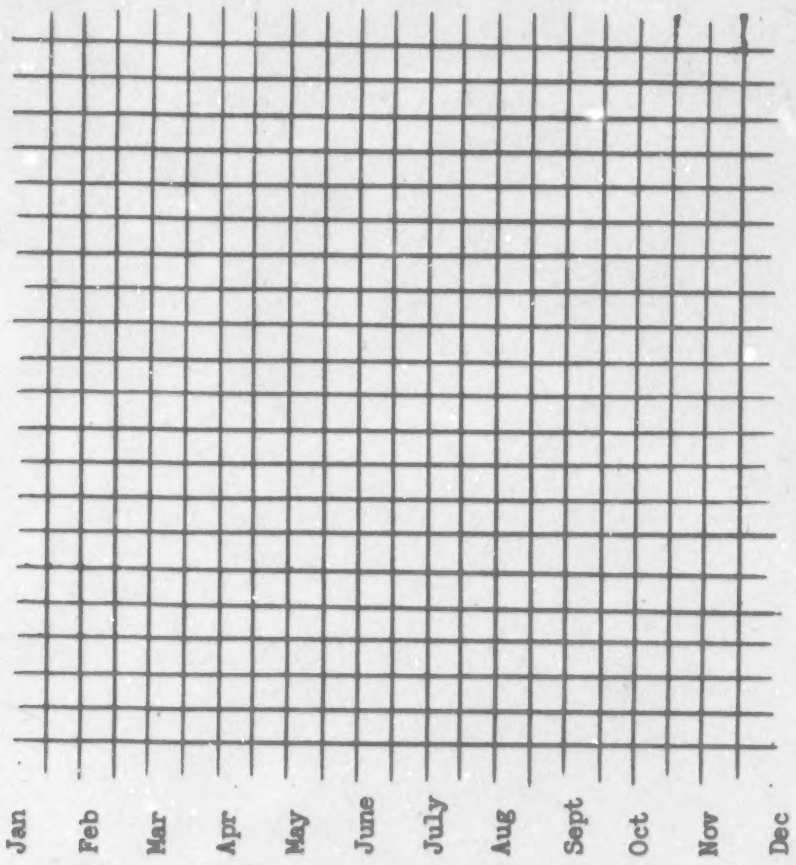
1. The greatest difference between the average high and the average low is during the month of _____.

2. The least difference between the average high and the average low occurs during the month of _____.



3. During _____ the temperature is more constant.

4. During _____ there is wider range of temperatures.

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Food and drink machines are a welcome sight at a service station, especially if you are just a little hungry or thirsty. If you would like to see how a simple matrix can function in this regard, complete the accompanying worksheet, C-3a.

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A service station has three vending machines.

One has candy bars at 10¢.
One has snacks at 15¢.
One has drinks at 20¢.

We can write these prices in a matrix form $\begin{pmatrix}10\\15\\20\end{pmatrix}$ and it is known as a price matrix.

Your family wants two candy bars, 0 snacks, and four drinks. This can be written in a different matrix for (2 0 4) and it is known as a demand matrix. You can multiply the demand matrix by the price matrix as follows:

$$(2 \quad 0 \quad 4) \times \begin{pmatrix}10\\15\\20\end{pmatrix} = (2 \times 10) + (0 \times 15) + (4 \times 20) = (20 \quad 0 \quad 80).$$

If you went back to the same vending machines the next day and bought one candy bar, two snacks, and three drinks, you could extend your demand matrix this way:

$$\begin{pmatrix}2 & 0 & 4\\1 & 2 & 3\end{pmatrix} \times \begin{pmatrix}10\\15\\20\end{pmatrix} = \begin{matrix}(2 \times 10) + (0 \times 15) + (4 \times 20)\\(1 \times 10) + (2 \times 15) + (3 \times 2)\end{matrix} = \begin{pmatrix}20 & 0 & 80\\10 & 30 & 6\end{pmatrix}$$

These are your expenditures for <u>two</u> days. If you add another day's purchase at the same machines, can you predict how the product will change?

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Have you ever played the game "Battleship"? A modified form of this game offers a fun way to learn to name the coordinates of a point with respect to the origin, in a Cartesian coordinate system in two dimensional space.

Read your directions and be ready to play as a group or in pairs. In the case of the latter, use the accompanying score sheet.

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MODIFIED BATTLESHIP GAME

This can be played by groups of two or larger.

1. In groups of two, each student has a score sheet, with twelve sets of points which can represent one quadrant or another, which is determined before each game starts, rotating to each of the four quadrants an equal number of times. Directions:
   a) One player is the aggressor.
   b) The other places three battleships on three locations, each covering two points.
   c) The aggressor names points by their coordinates and records each on his own "grid". He might say "fire", then give the coordinates of the point. If his opponent has a battleship on that point, he calls "hit", and the aggressor records an x on it. If there is no battleship on that point, the opponent calls "miss" and the aggressor records a O on the point. When a battleship receives its second "hit", the opponent answers "sunk".
   d) The aggressor continues to call points until he has "sunk" all three of his opponents battleships. Then he and his opponent switch roles. When his opponent - who is now the aggressor - has sunk his three battleships, one game is completed and the winner is which-ever aggressor sunk his opponent's three battleships with the least number of rounds of "fire"; i.e., naming the least number of points.
2. When the game is played by the whole class, you need a portable chalkboard and a large piece of butcher paper. Divide the class in two groups, each with a "caller". Each group is on opposite sides of the chalkboard. The chalkboard has two large grids on it. The butcher paper, attached to the back of the chalkboard also has two grids on it. The game proceeds the same as for two players, except each member of the aggressor group tells the caller what points to call out, and the caller records the results. Each group plays two games to determine the winner in the same fashion as two players.

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Score Sheet for Battleship

Quadrant _____

Coordinates of Points

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.

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Write a letter to:

The Vacation Exchange Club
663 Fifth Avenue
New York, N.Y. 10022

for an application form and membership rates. (This involves trading the use of your house for the use of someone else's house and seldom is a direct trade.)

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If a plane must go 350 miles, can average 300 m.p.h., and has a tail wind of 50 m.p.h., how long will it take to go the 350 miles? Assume that the tail wind adds an additional 50 m.p.h. to the speed.

If a plane's destination is 350 miles, can average 300 m.p.h., and has a head wind of 50 m.p.h., how long will it take to go the 350 miles? Assume that the head wind has the effect of reducing the speed of 50 m.p.h.

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If you are given map C-7a and you know that Dallas is approximately 1000 air miles from Salt Lake City, find the following distances:

Seattle to Las Vegas	St. Louis to Buffalo
Omaha to San Diego	Memphis to New Orleans
Houston to Atlanta	Washington, D.C. to Dallas
Boston to Chicago	Detroit to Chicago

Use any method you want. C-7b has space provided for your results.

Compare your results from C-7b with table A-8c to see how good your distances were.

What method or methods did you use?

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Seattle
Salt Lake City
Las Vegas
San Diego
Omaha
Topeka
Chicago
Detroit
Buffalo
Boston
Washington, D.C.
St. Louis
Memphis
Atlanta
Dallas
Houston
New Orleans

C-7a

FROM	TO	DISTANCE
Dallas	Salt Lake City	1,000
Seattle	Las Vegas	
Omaha	San Diego	
Houston	Atlanta	
Boston	Chicago	
St. Louis	Buffalo	
Memphis	New Orleans	
Washington, D.C.	Dallas	
Detroit	Chicago	

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If 1/2 inch on a scale is equivalent to two miles, fill in the following blanks, using

1/4 inch = _____ miles

_____ inch = 2 miles

1 inch = _____ miles

1 1/2 inches = _____ miles

_____ inches = 8 miles.

Graph the information given above on the graph on C-8a. Connect the points. Is the connecting line

1) a curve, which is not a straight line?

2) a straight line?

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a) 1/4 inch = _____ miles

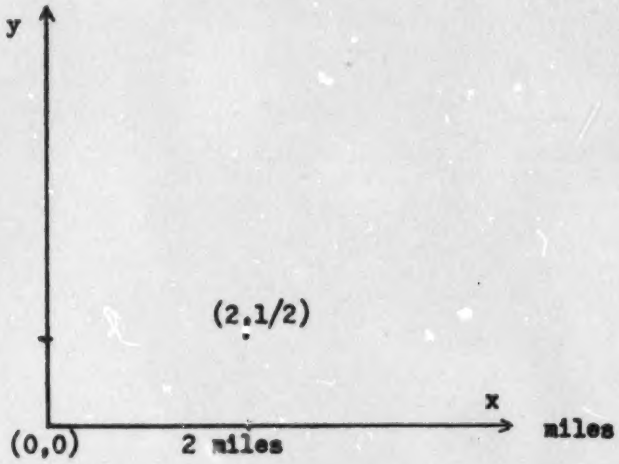
_____ inches = 2 miles

1 inch = _____ miles

1 1/2 inches = _____ miles

_____ inches = 8 miles

b) inches



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Use map C-9a to help solve the crossword puzzle, by finding the coordinate pairs for the solutions across and down.

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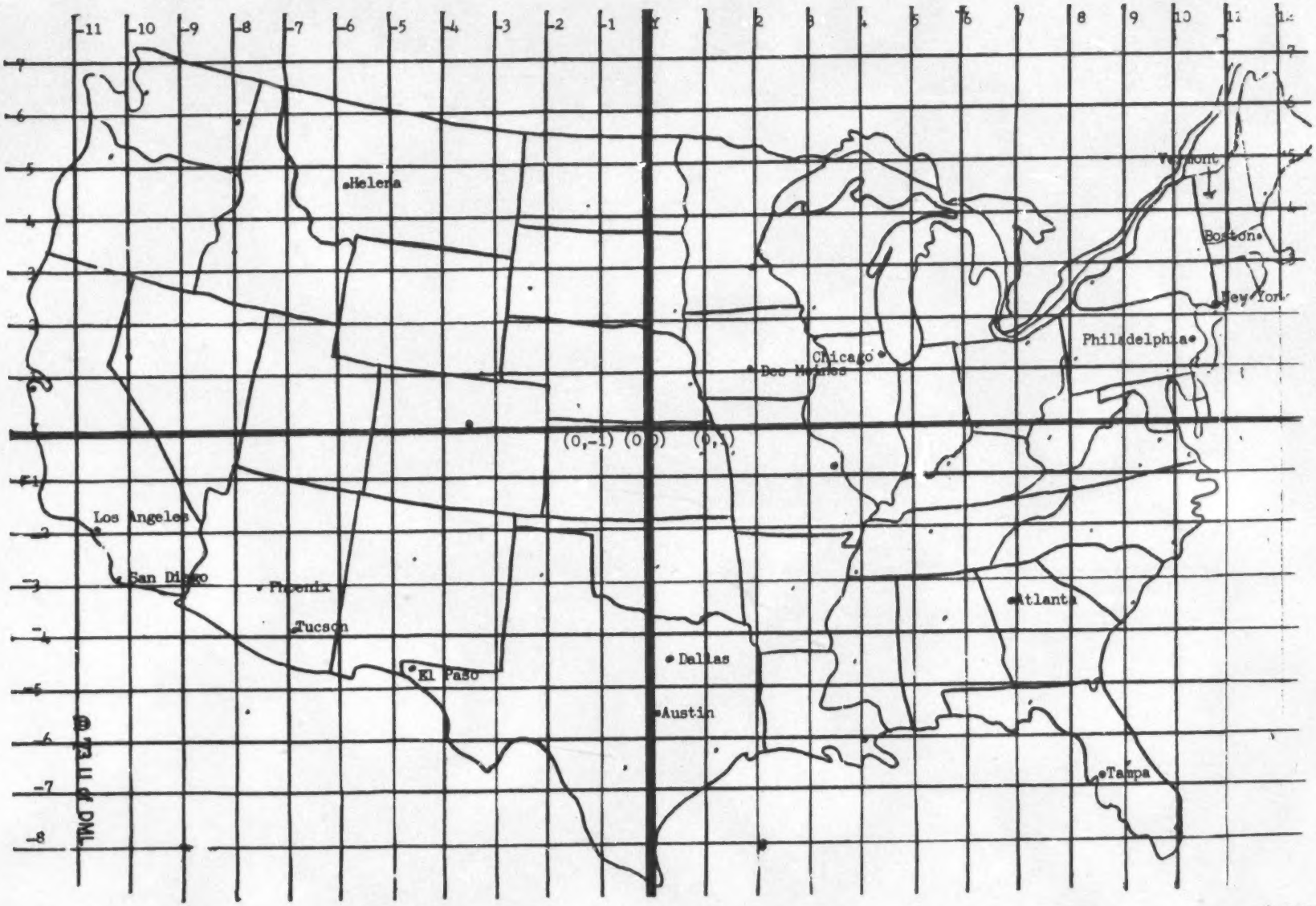
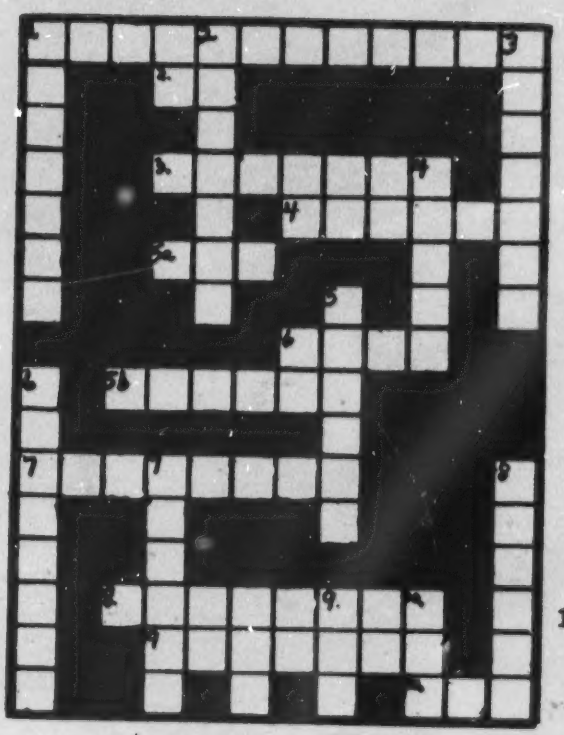

Helena
Los Angeles
San Diego
Phoenix
Tucson
El Paso
Dallas
Austin
Chicago
Philadelphia
Boston
Atlanta
Tampa
(0,-1) (0,0) (0,1)

C-9a

ACROSS

1. The city at (10 1/4, 1 3/4)
2. (10 2/3, 2 1/3) is the location of this abbreviated building where top officials from different countries meet
3. Name of the shaded state
4. The city at (-4 1/2, -4 1/3)
5. The city at (2, 1 1/3)
   a) First part of the name
   b) Second part of the name
6. State that (2, 1 1/3) is in
7. The city at (-9 4/5, -2 2/3)
8. State that (4 1/2, 1 1/2) is in
9. The city at (6 3/4, -3 1/4)
10. The first 3 letters of the state that (-5 2/3, 4 2/3) is capitol of.



DOWN

1. The city at (-7 1/3, -2 4/5)
2. The second part of the city at (-10 1/4, -1 2/3)
3. The state that 1 down and 8 down are located in
4. The city at (8 1/2, -6 1/2)
5. The city at (11 1/2, 3 2/3)
6. The city at (0, -5 1/2)
7. The city at (1/3, -4 1/3)
8. The city at (-6 4/5, -3 4/5)
9. Solitaire (not referring to map
10. Name (usually a guy's)

C-96

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Posttest

(A take-home test)

Plan a trip from Denver, Colorado, to Seattle, Washington. Make the trip from Denver to Seattle by automobile, and the return trip by the airline of your choice.

Be sure to answer all of the following questions.

When going to Seattle, plan to go by way of Salt Lake City, Boise, Portland, and then to Seattle.

1) What is the distance?
2) What highways would you travel?
3) What do you estimate the cost of auto expenses to be?
4) What is the cost per mile?
5) What do you estimate the time of travel to be?
6) How much will you need for motel rental?
7) How much will food cost per person?
8) Where do you change time zones?
9) How far will you travel each day?
10) How many miles will you cover each day?
11) If the trip is planned during July, what temperatures may you expect?
12) Include any other important facts.

Plan to return on the cheapest airline, and buy a coach fare. Include answers to the following:

1) What airlines fly between Denver and Seattle?
2) What does a coach fare for one cost?
3) Is a meal included?
4) What are departure and arrival times?
5) What is the air mileage?
6) How long does the flight take?
7) What is the cost per mile?
8) How fast will the airplane travel if it is to be on schedule?
9) How much would it have cost to return by first class?
10) Include any other important facts.

Include anything else you may have learned in this unit.

Posttest

(A take-home test)

Plan a trip from Denver, Colorado, to Seattle, Washington. Make the trip from Denver to Seattle by automobile, and the return trip by the airline of your choice.

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